

Basewide Energy Systems Plan

Executive Summary

Final Report

Fort Benning, Georgia

EXPERIMENTAL STUDY

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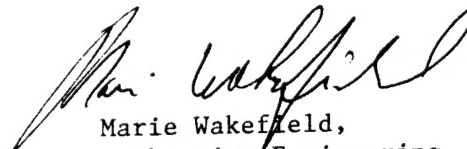


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EXECUTIVE SUMMARY - INCREMENTS A, B, C, D, AND E

This is a summary of the results for Increments A, B, C, D, and E of the Basewide Energy Systems Plan for Fort Benning, Georgia (the results for Increments F and G are summarized on pages 5 and 6). The plan includes analyses and recommendations of energy conservation projects for reduction of the installation's present energy consumption. The recommended projects provide partial compliance with the energy conservation requirement for the installation as outlined in the Army Facilities Energy Plan. This summary presents data on the following:

- Existing energy consumption
- Source energy reductions due to energy conservation techniques for buildings and their systems
- Application of solar energy to reduce fossil fuel consumption
- Savings utilizing central energy monitoring and control systems (EMCS)
- Use of solid waste as an alternate energy source
- Analysis of Total Energy/Selective Energy (TE/SE) systems

Tables 1 and 2 present information pertaining to the physical descriptions and energy consumption of 49 typical buildings used to verify historical energy consumption in the development of the basewide energy use model. This model was then utilized as the foundation for energy conservation project analyses and recommendations. Table 3 summarizes the daily personnel occupancy for each typical building. Tables 1, 2 and 3 also provide information which may be used to estimate

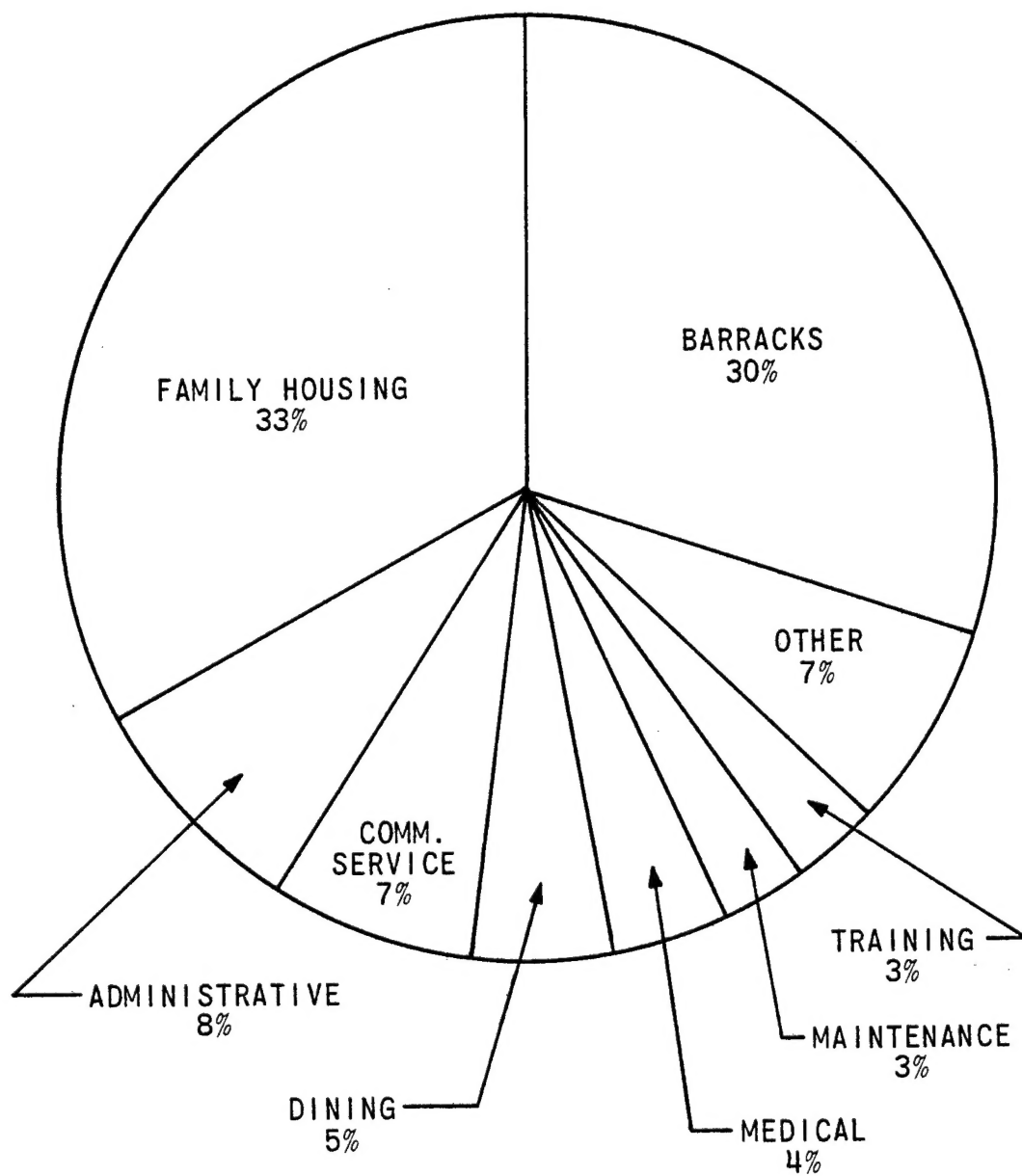
source energy consumption for similar buildings within the designated groupings (see Appendix A for all tables referenced in this report). The estimated annual source energy consumption for all building types contributing to the basewide annual total of 3,937,446 mega-Btu, consumed during base year 1975, is shown on Figure 1.

Table 4 indicates the annual source energy consumed by each of the significant building groups used in our basewide energy model. The model was within 4 percent of the historical source energy consumption for FY 1975 shown below.

Yearly Source Energy Consumption in Btu x 10 ⁶	
<u>1975</u>	
Electricity	1,722,368
Natural Gas	1,947,748
Propane Gas	96,096
Fuel Oil No. 2	121,425
Fuel Oil No. 4	14,022
Fuel Oil No. 6	28,288
Kerosene	<u>7,499</u>
TOTAL	3,937,446

The total estimated source energy savings due to implementation of all feasible energy conservation projects developed within the scope of Increments A, B, C, D and E of this study is 1,030,686 mega-Btu/year. These projects consisted of various architectural improvements, and mechanical and electrical system modifications.

Table 5 lists the project number, percent of basewide reduction, and the source energy savings for the indicated building types. Figure 2

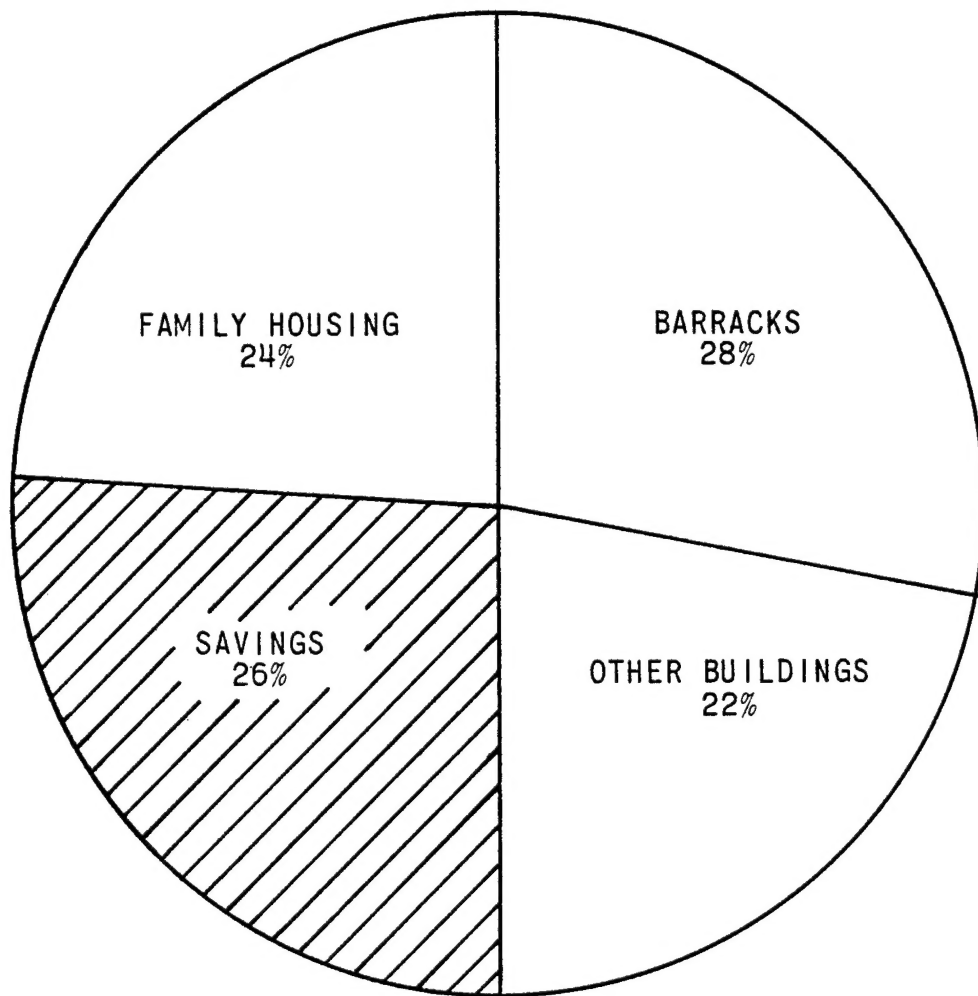


CONSUMPTION FOR FY '75

FIGURE 1

illustrates the combined effect of the recommended energy saving improvements, as compared to the FY 1975 source energy expenditure. Our estimates indicate a savings of approximately 26 percent over the base year (1975). Figure 3 illustrates the relative percent reduction for significant building groups comprising the 1,030,686 mega-Btu/year.

A detailed analysis of the projects listed in Table 5 is included in the following reports. Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis, can be found in the Energy Use Survey. The reduction of Fort Benning's dependence on nonrenewable energy sources by utilizing solar energy, a renewable energy source, indicates a total savings of 2,003 mega-Btu/year. Eight concepts were evaluated and are presented in the Solar Energy Applications and Evaluations. The Energy Monitoring and Control System (EMCS) study includes recommendations for an extension of the existing system and the utilization of an FM control system. An extension of the existing system would result in a savings of 28,011 mega-Btu/year, while the FM control system would save 93,910 mega-Btu/year. The investigation of solid waste for reducing source energy consumption at Fort Benning resulted in the development of Project No. T-611, which recommends the installation of a solid waste-burning incinerator facility to provide steam to the existing steam distribution system. The proposed plant, to be located in the Kelley Hill Area, would provide reduction in both fuel oil and electric consumption totalling 204,124 mega-Btu/year. The details and descriptions of the systems analyzed can be found in the report entitled Total Energy, Selective Energy, and Central Boiler Plants.



PROJECTED CONSUMPTION AFTER
ENERGY CONSERVATION PROJECTS

FIGURE 2

ALLOCATION OF ENERGY
CONSERVATION PROJECTS SAVINGS

FOR SIGNIFICANT BUILDING GROUPS

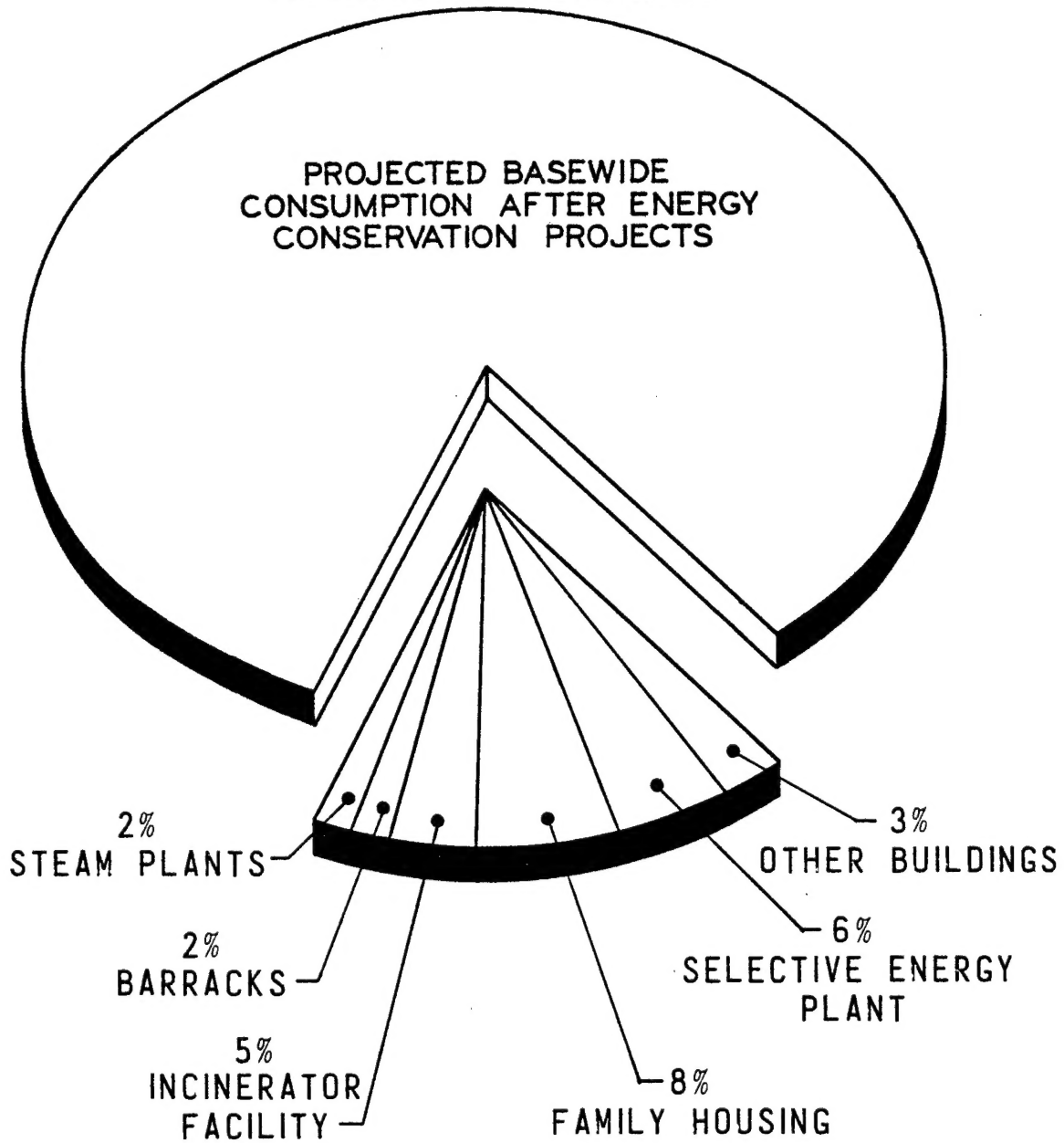


FIGURE 3

The incorporation of a total energy system at this installation would not be recommended. However, a selective energy plant would save 5.7 percent of the source energy used at Ft. Benning. A reduction in basewide use of natural gas and fuel oil would amount to 39 percent. The plant would be capable of generating 18 percent of the required basewide electrical power, while shaving the annual electrical peak by 10 percent. Detailed descriptions of the TE/SE systems analyzed are included in the Total Energy, Selective Energy, and Central Boiler Plants report.

Table 6 was developed to give a prioritized schedule, in order of fiscal year, for implementing the recommended energy conservation projects.

EXECUTIVE SUMMARY-INCREMENTS F AND G

Increment F - Facilities Engineer Conservation Measures.

Increment G - Maintenance, Repair, and Minor Construction Projects.

This is a summary of the two phases of work that were started after the completion of Increments A, B, C, D, and E in May of 1980. Increments F and G were completed in November, 1982.

The purpose of Increment F of the Basewide Energy Systems Plan is to identify and develop recommendations that can be used by Fort Benning in preparing its energy management plan. Included are a number of comparatively low cost projects, recommendations for training, and prioritized lists of possible energy conservation measures. Increment G identified maintenance, repair, and minor construction projects for the purpose of conserving energy. These are energy conservation projects that did not meet ECIP criteria or did not fit the ECIP program at the time that the remainder of the study was completed.

The average costs of energy for FY 1981 are given in Table 7. These costs have been used as the basis for determining the dollar savings per year.

Recommended projects developed within the scope of Increments F and G of the study are summarized in Tables 8 and 9 respectively. Projects are prioritized by their E/C ratio. The E/C ratio is defined as the ratio of yearly energy savings in million Btu to the cost estimate in thousands of dollars. Any project showing a payback of 15 years or less is recommended. Cost estimates are representative of April, 1981 prices.

Figure 4 is a pie chart showing projected future energy savings due to ECIP projects developed under Increments A, B, C, D, and E that are planned for future implementation and projects developed under Increments F and G.

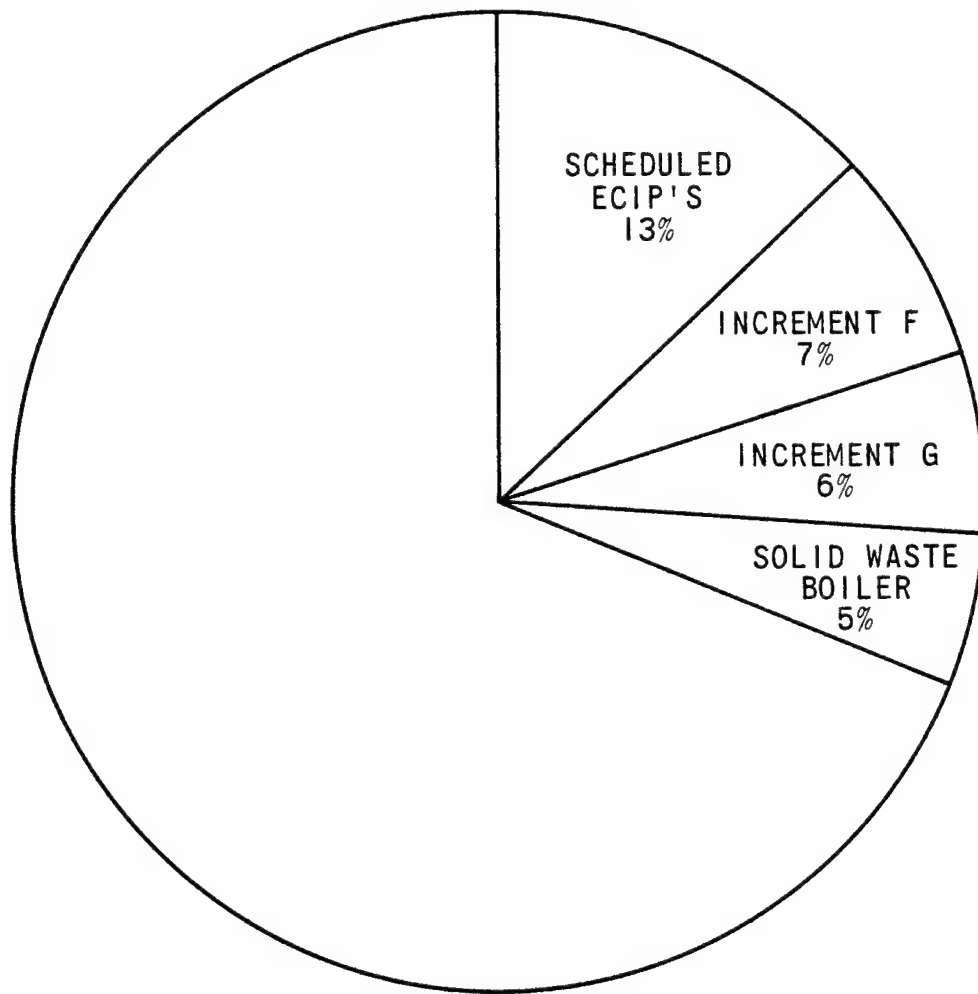
Figure 5 represents a forecast of Fort Benning's future energy costs. The figure shows how costs could escalate if no energy conservation projects are implemented and what also could happen if all cost effective projects are implemented. The energy conservation projects are assumed to be implemented in four phases:

Phase I - ECIP.

Phase II - Increments F and G.

Phase III - Solid Waste Plant.

Phase IV - Selective Energy Plant that would burn coal to produce all the steam requirements of the main post area and part of the electrical requirements of Fort Benning.



FORT BENNING
BASEWIDE CONSUMPTION FY '81
 $4,418,032 \times 10^6$ BTU'S

FIGURE 4

EFFECT OF ESCALATION AND ENERGY CONSERVATION ON FUEL COST

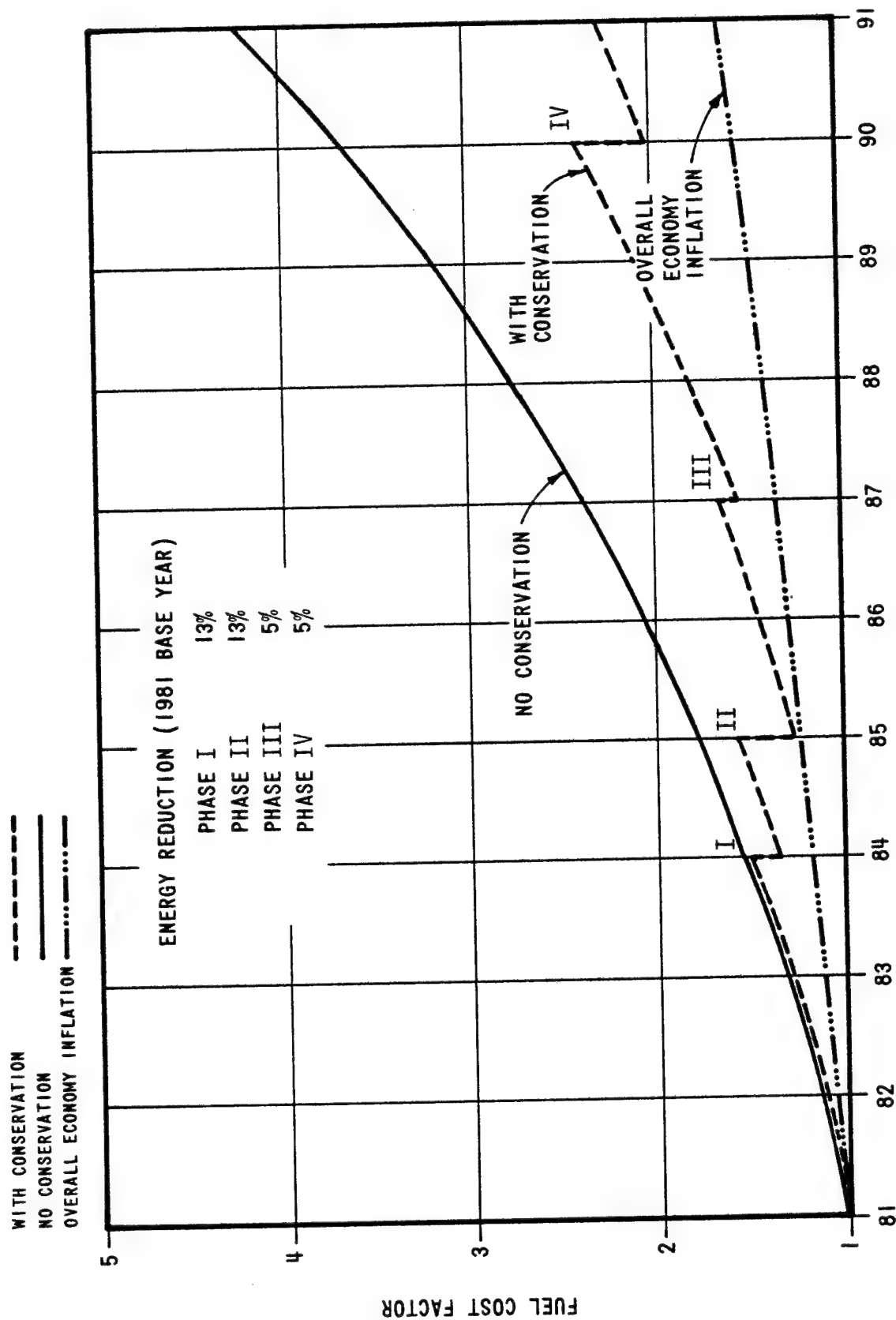


FIGURE 5

APPENDIX A

. TABLES

TABLE I
TYPICAL BUILDING CONSTRUCTION DATA
FORT BENNING

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NO. FLS.	CONSTRUCTION					"U" VALUES						WINDOM NO. FT.	AREA (FT. ²)	COOLING		HEATING		PEAK TRMS LOAD MBH		DOMESTIC HOT WATER		
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOM	DOOR	SYSTEM			CAP. (TONS)	SYSTEM	FUEL	GAIN	LOSS	CAP. (G)	FUEL		
A-1	2749	BRIGADE HEADQUARTERS	3	BUILT-UP CONCRETE BLOCK	CONCRETE BLOCK	FIRST FL. HALF UNDERGROUND	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.08	.51	1.13	.55				734	9043	CENTRAL	32	B.P. 2763	STEAM	56.3	150.2	40	STEAM
A-2	2806	ADMINISTRATION	1	CONCRETE BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.17	.33	1.13	.49				353	2578	WINDOM UNIT	1	B.P. 2763	STEAM	5.7	82.0	40	GAS
A-3	3001	HEADQUARTERS	2	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	TILE, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.29	.32	1.13	.49				420	3270	CENTRAL	9	FURNACE	LPG	30.0	69.2	30	ELEC
A-4	5389	SHOP & STORAGE	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.29	.32	1.13	.49				200	1520	NONE	—	FURNACE	OIL	—	47.8	30	OIL
B-1	2814	BARRACKS	3	BUILT-UP CONCRETE BLOCK	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.06	.13	1.13	.55				2162	40536	CENTRAL PLANT	54	B.P. 2763	STEAM	12.6	87.2	200	STEAM
B-2	9018	BARRACKS	3	BUILT-UP CONCRETE BLOCK	CONCRETE BLOCK	CONC., VENTED CRAWL SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.06	.13	1.13	.55				5750	50620	CENTRAL	74	B.P. 9029	STEAM	202.1	517.4	1000	STEAM
B-4	1862	BARRACKS	3	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.29	.32	1.13	.49				450	4720	NONE	—	FURNACE	GAS	—	83.6	85	OIL
B-5	399	B.O.Q.	3	CLAY SHINGLE & BUILT-UP	BRICK & CONCRETE	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.74	.26	1.13	.55				27215	301735	CENTRAL PLANT	370	B.P. 2763	HOT WATER	1643	3458.0	1000	GAS
B-6	36	GUEST HOUSE	2	CLAY SHINGLE	STUCCO 12" TILE	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.28	.14	1.13	.49				940	13971	WINDOM UNITS	36	BOILER	GAS	109.0	272.7	100	STEAM
B-7	4874	DAYROOM	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.32	1.13	.49				230	1843	NONE	—	FURNACE	OIL	—	102.2	30	ELEC
CS-1	2608	SPANISH SUNDAY SCHOOL	2	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	WOOD	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.26	1.13	.49				411	4790	WINDOM UNITS	5	FURNACE	GAS	85.3	198.6	30	GAS
CS-2	4486	CHAPEL	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.32	1.13	.49				362	5238	CENTRAL	15	BOILER	OIL	45.5	108.9	60	GAS
CS-3	110	POST OFFICE	1	SHINGLE ASPHALT	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.11	.30	1.13	.49				1758	12658	PACKAGE UNIT	40	UNIT HEATERS	GAS	98.2	242.8	90	ELEC
CS-4	3357	P.X. & PUB	1	SHINGLE ASPHALT	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.11	.32	1.13	.49				490	4710	CENTRAL	22	FURNACE	OIL	107.5	234.1	100	OIL
CS-5	4840	CLASSROOM #2	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.32	1.13	.49				384	3463	NONE	—	FURNACE	GAS	45.5	108.9	40	GAS
CS-6	1796	GEN. EDUCATIONAL DEVELOPMENT CTR.	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.32	1.13	.49				355	5071	CENTRAL	19	FURNACE	GAS	77.4	169.0	40	GAS
CS-7	9230	COMMISSARY	1	BUILT-UP BRICK, CONC. BLOCK	BRICK, CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.18	.42	1.13	.55				2865	321203	ABSORP-TION	440	BOILERS	GAS	1069	2037.0	100	GAS
CS-8	933	FIELD HOUSE	1	BUILT-UP BRICK	BRICK	WOOD FLOOR BASEMENT	GLASS BLOCK CLEAR GLASS	WOOD SOLID CORE	.40	.37	1.13	.49				3308	38396	NONE	—	BOILER	GAS	—	1172.0	75	GAS
CS-9	9049	BOWLING ALLEY	1	BUILT-UP CONCRETE BLOCK	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.08	.53	1.13	.55				81	10136	CENTRAL	36	UNIT HEATERS	GAS	87.6	190.3	70	GAS
CS-10	4410	RECREATION CENTER	2	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.33	.32	1.13	.49				870	17682	CENTRAL	54	BOILER	OIL	95.4	174.1	80	GAS
CS-11	2533	LATRINE	1	BUILT-UP CONCRETE BLOCK	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.12	.56	1.13	.55				30	362	NONE	—	UNIT HEATER	LPG	—	17.2	—	NONE
D-1	2067	MESS HALL	1	SHINGLE ASBESTOS	WOOD FRAME, WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.32	1.13	.49				450	2517	NONE	—	UNIT HEATER	GAS	—	97.0	75	GAS
D-2	227	M.C.O. CLUB	1	BUILT-UP & SHINGLE	BRICK	WOOD JOIST & SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.32	.33	1.13	.49				1347	14019	CENTRAL	35	BOILER	GAS	142.5	275.5	75	GAS
FN-1	812	FAMILY HOUSING	2	CLAY SHINGLE	STUCCO 12" TILE	WOOD JOISTS, CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.28	.14	1.13	.49				1243	11336	WINDOM UNITS	6	BOILER	GAS	15.8	220.9	100	GAS
FN-2	10820	FAMILY HOUSING	1	SHINGLE ASBESTOS	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.06	.20	1.13	.49				269	2376	CENTRAL	7	FURNACE	GAS	17.4	51.6	60	GAS
FN-3	10329	FAMILY HOUSING	1	SHINGLE	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.17	1.13	.49				368	2626	CENTRAL	8	FURNACE	GAS	19.3	56.8	80	GAS

BLE I (CONT'D)
LDING CONSTRUCT
FORT BENNING

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NO. FLS.	CONSTRUCTION					"U" VALUES					WINDOW SQ. FT.	AREA (FT.²)	COOLING		HEATING		PEAK TNS LOAD MBH		DOMESTIC HOT WATER CAP. (G)	
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR			SYSTEM	CAP. (TONS)	SYSTEM	FUEL	LOAD	GAIN		LOSS
PH-4	1855	FAMILY HOUSING	1	ASBESTOS SHINGLE	WOOD FRAME, BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD HOLLOW CORE	.06	.17	—	1.13 1.06	.49 .47	510	3108	CHILLER	6	BOILER	GAS	22.5	62.1	50	GAS
PH-5	1938	FAMILY HOUSING	2	ASBESTOS SHINGLE	WOOD FRAME, BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD HOLLOW CORE	.07	.08	—	1.13 1.06	.49 .47	400	3098	CENTRAL	6	FURNACE	GAS	17.3	47.2	50	GAS
PH-6	9481	FAMILY HOUSING	1	ASPHALT SHINGLE	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.04	.07	—	1.13 1.06	.49 .47	240	3530	PACKAGE UNITS	5	FURNACE	GAS	12.7	44.9	50	GAS
PH-7	457	FAMILY HOUSING	1	ASPHALT SHINGLE	STUCCO	WOOD JOISTS CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.23	.26	1.13 1.06	.49 .47	360	3386	NONE	—	BOILER	GAS	—	52.8	40	GAS
PH-8	947	FAMILY HOUSING	2	ASBESTOS SHINGLE	WOOD SIDING BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD HOLLOW CORE	.14	.35	—	1.13 1.06	.49 .47	1524	10584	WINDOW UNITS	1	FURNACE	GAS	5.9	255.1	100	GAS
H-1	265	HOSPITAL, VETERANARIAN	2	CLAY SHINGLE	BRICK	WOOD JOIST & SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.28	.32	.54	1.13 1.06	.49 .47	620	9163	WINDOW UNITS	35	BOILER, U. HEATERS	GAS	80.0	232.0	75	GAS
H-2	4695	DENTAL CLINIC	1	ASBESTOS SHINGLE	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.07	.37	—	1.13 1.06	.55 .47	214	3696	CENTRAL	14	BOILER	DIL	32.0	92.6	70	GAS OIL
L-1	2500	LAUNDRY	1	ASPHALT SHINGLE	WOOD FRAME, ASBESTOS	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.51	.57	—	1.06	.47	4593	51413	NONE	—	B.P. 2763	STEAM	—	721.4	N/A	—
M-1	9034	MOTOR POOL	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.61	.47	—	1.13 1.06	.55 .47	907	5038	NONE	—	B.P. 9029	STEAM	—	220.4	—	NONE
M-2	5075	VEHICLE MAINTENANCE	1	ASBESTOS SHINGLE	WOOD FRAME, ASBESTOS	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.29	.57	—	1.13 1.06	.49 .47	225	3148	NONE	—	BOILER	DIESEL	—	79.7	—	NONE
M-3	1679	MAINTENANCE	1	CORRUGATED IRON	CORRUGATED IRON	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.39	.23	—	1.13 1.06	.55 .47	30	996	CENTRAL	4	UNIT HEATER	GAS	14.0	40.9	30	GAS
T-1	2824	TRAINING FACILITIES	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.45	.47	—	1.13 1.06	.55 .47	1005	3555	WINDOW UNIT	4	B.P. 2763	STEAM	10.3	29.0	40	GAS
T-2	9055	TRAINING FACILITIES	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.35	.51	—	1.13 1.06	.55 .47	560	6138	CENTRAL	22	B.P. 9029	STEAM	51.6	134.9	40	ELEC
T-3	4628	TRAINING FACILITIES	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.35	.51	—	1.13 1.06	.55 .47	500	9483	NONE	—	FURNACE	LPG	—	150.3	40	ELEC
U-1	—	WASTE WATER TREATMENT	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	3154	NONE	—	NONE	—	—	—	NONE	
U-2	—	WATER TREATMENT	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	6211	NONE	—	NONE	—	—	—	NONE	
U-3	—	PUMP HOUSE	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	4957	NONE	—	NONE	—	—	—	NONE	
U-4	9029	STEAM PLANT	1	BUILT-UP	METAL & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.66	.53	—	1.13 1.06	.55 .47	400	7356	NONE	—	UNIT HEATERS	STEAM	—	50.3	30	STEAM
W-1	2528	WAREHOUSE	2	ASPHALT SHINGLE	WOOD FRAME WOOD SIDING	JOISTS, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.20	.32	.54	1.13 1.06	.49 .47	490	4720	WINDOW UNIT	1	FURNACE	GAS	15.3	33.6	30	GAS
W-2	336	WAREHOUSE	1	CORRUGATED TIN	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL	.68	.44	—	1.13 1.06	.55 .47	684	15140	NONE	—	UNIT HEATERS	GAS	—	335.7	30	GAS
W-3	2632	STORAGE	1	ASPHALT SHINGLE	WOOD FRAME, WOOD SIDING	CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.20	.32	.24	1.13 1.06	.49 .47	100	1332	NONE	—	UNIT HEATERS	GAS	—	46.2	—	NONE
X	—	BUILDING - NO UTILITIES	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Z	—	BUILDING - ELECTRIC ONLY (INCLUDES OUTDOOR LIGHTING AND ELECTRIC AUXILIARIES)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 2
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT BENNING

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTU x 10 ⁶			ELEC'L ENER. CONSUMPTION		BTU x 10 ³ FT ²
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
A-1	2749	BRIGADE HEADQUARTERS	518	2636	3154	81.3	227279	320.4
A-2	2806	ADMINISTRATION	305	158	463	4.7	13604	179.6
A-3	3001	HEADQUARTERS	267	354	621	17.3	30515	189.9
A-4	5389	SHOP & STORAGE	190	24	214	0.95	2069	140.8
B-1	2814	BARRACKS	7080	3927	11007	92.4	338528	271.5
B-2	9018	BARRACKS	5352	5182	10534	196.8	446771	208.1
B-4	4862	BARRACKS	819	330	1149	6.6	28435	243.4
B-5	399	B.O.O.	36221	17041	53262	411.5	469033	176.5
B-6	36	GUEST HOUSE	1724	1776	3500	76.4	153083	250.5
B-7	4874	DAYROOM	330	26	359	2.7	2472	194.8
CS-1	2608	SPANISH SUNDAY SCHOOL	657	114	771	10.5	9874	160.7
CS-2	4486	CHAPEL	410	1051	1461	34.8	90630	451.2
CS-3	110	POST OFFICE	1307	1615	2922	74.0	139216	230.8
CS-4	3357	P.X. & PUB	861	863	1724	47.7	74392	366.0
CS-5	4840	CLASSROOM #2	427	163	590	4.9	14056	161.1
CS-6	1796	GEN. EDUCATIONAL DEVELOPMENT CTR.	675	735	1410	36.8	63345	278.1
CS-7	9230	COMMISSARY	35858	8642	44500	158.1	745021	138.5
CS-8	933	FIELD HOUSE	7248	715	7963	25.2	61650	207.4
CS-9	9049	BOWLING ALLEY	639	3377	4016	95.7	291117	396.2
CS-10	4410	RECREATION CENTER	1912	1588	3500	85.1	136880	197.9
CS-11	2533	LATRINE	30	—	30	—	—	82.9
D-1	2067	MESS HALL	1304	126	1430	3.6	10833	568.1
D-2	227	N.C.O. CLUB	8905	1686	10591	77.9	145364	755.5
FH-1	812	FAMILY HOUSING	1576	866	2442	30.4	74670	215.4
FH-2	10820	FAMILY HOUSING	298	280	578	10.5	24110	243.3
FH-3	10329	FAMILY HOUSING	278	317	595	13.2	27350	226.6

TABLE 2 (CONT'D)
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT BENNING

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTU x 10 ⁶			ELEC'L ENER. CONSUMPTION		BTU x 10 ³ FT ²
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
FH-4	1855	FAMILY HOUSING	412	318	730	11.7	27443	234.9
FH-5	1938	FAMILY HOUSING	220	336	556	11.9	28921	179.5
FH-6	9481	FAMILY HOUSING	388	334	722	10.5	28751	204.5
FH-7	457	FAMILY HOUSING	313	105	418	1.9	9016	123.4
FH-8	947	FAMILY HOUSING	1120	2296	3416	37.9	197901	322.8
H-1	265	HOSPITAL, VETERANARIAN	866	1764	2630	92.1	182051	287.0
H-2	4695	DENTAL CLINIC	346	845	1191	36.8	72821	322.2
L-1	2500	LAUNDRY	30921	1767	32688	102.5	152308	635.8
M-1	9034	MOTOR POOL	482	82	564	2.3	7090	111.9
M-2	5075	VEHICLE MAINTENANCE	309	3	312	0.1	276	99.1
M-3	1629	MAINTENANCE	111	235	346	10.7	20242	347.4
T-1	2824	TRAINING FACILITIES	637	253	890	12.6	21824	250.4
T-2	9055	TRAINING FACILITIES	335	1915	2250	64.0	165121	366.6
T-3	4628	TRAINING FACILITIES	593	697	1290	30.1	60108	235.3
U-1	—	WASTE WATER TREATMENT	0	5572	5572	54.8	480340	1766.6
U-2	—	WATER TREATMENT	0	43412	43412	427.23	742436	6989.5
U-3	—	PUMP HOUSE	0	62342	62342	613.55	374319	12551.1
U-4	9029	STEAM PLANT	14	124	138	1.2	10862	18.8
W-1	2528	WAREHOUSE	117	162	279	6.3	13988	59.1
W-2	336	WAREHOUSE	754	222	976	6.5	19168	64.5
W-3	2632	STORAGE	109	16	125	0.6	1341	93.8
X	—	NO UTILITIES	N/A					
Z	—	ELECTRIC ONLY	0	136905	136905	121.3	9616015	N/A

TABLE 3
BUILDING OCCUPANCY
FORT BENNING

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NORMAL PEAK POPULATION	OCCUPANCY
A-1	2749	BRIGADE HEADQUARTERS	25	OPEN 24 HOURS
A-2	2806	ADMINISTRATION	8	WEEKDAYS - OPEN 24 HOURS, SOMETIMES SATURDAY
A-3	3001	HEADQUARTERS	5	WEEKDAYS - 6:00 A.M. TO 7:00 P.M.
A-4	5389	SHOP & STORAGE	2	WEEKDAYS - 6:00 A.M. TO 6:00 P.M.
B-1	2814	BARRACKS	156	OPEN 24 HOURS
B-2	9018	BARRACKS	73	OPEN 24 HOURS
B-4	4862	BARRACKS	58	OPEN 24 HOURS
B-5	399	B.O.Q.	1660	OPEN 24 HOURS
B-6	36	GUEST HOUSE	50	OPEN 24 HOURS
B-7	4874	DAYROOM	15	SATURDAY - 8:00 A.M. TO 10:00 P.M. SUNDAY - 12:00 NOON TO 9:00 P.M.
CS-1	2608	SPANISH SUNDAY SCHOOL	50	SUNDAY - 9:30 A.M. TO 11:00 A.M.
CS-2	4486	CHAPEL	100	SUNDAY - 9:30 A.M. TO 12:00 A.M.
CS-3	110	POST OFFICE	6	WEEKDAYS - 6:30 A.M. TO 6:00 P.M. SATURDAY - 6:00 A.M. TO 3:00 P.M.
CS-4	3357	P.X. & PUB	65	WEEKDAYS - 9:00 A.M. TO 6:00 P.M. - 6:00 P.M. TO 11:00 P.M. SATURDAY & SUNDAY - NOON TO MIDNIGHT
CS-5	4880	CLASSROOM #2	144	WEEKDAYS - 6:30 A.M. TO 4:30 P.M.
CS-6	1796	GEN. EDUCATIONAL DEVELOPMENT CTR.	50	WEEKDAYS - 6:30 A.M. TO 4:30 P.M.
CS-7	9230	COMMISSARY	500	TUESDAY & SATURDAY - 9:00 A.M. TO 6:00 P.M. / THURSDAY - 9:00 A.M. TO 7:30 P.M. WEDNESDAY & FRIDAY - 9:00 A.M. - 6:30 P.M. / CLOSED MONDAY
CS-8	933	FIELD HOUSE	200	WEEKDAYS - 11:00 A.M. TO 9:00 P.M. SATURDAY & SUNDAY 9:00 A.M. TO 1:00 P.M.
CS-9	9049	BOWLING ALLEY	60	TUESDAY - FRIDAY - 1:00 P.M. TO 10:00 P.M. / CLOSED MONDAY SATURDAY & SUNDAY - 8:00 A.M. TO 5:00 P.M.
CS-10	4410	RECREATION CENTER	200	WEEKDAYS & SATURDAY - 1:00 P.M. TO 10:00 P.M. SUNDAY & HOLIDAYS - 10:00 A.M. TO 7:00 P.M.
CS-11	2533	LATRINE	19	OPEN 24 HOURS
D-1	2067	MESS HALL	200	7 DAYS A WEEK - 3:30 A.M. TO 6:30 P.M.
D-2	227	N.C.O. CLUB	300	WEEKDAYS 6:00 P.M. TO 11:00 P.M. SATURDAY - 1:00 P.M. TO 1:00 A.M. / SUNDAY - NOON TO MIDNIGHT
FH-1	812	FAMILY HOUSING	20	OPEN 24 HOURS
FH-2	10820	FAMILY HOUSING	8	OPEN 24 HOURS
FH-3	10329	FAMILY HOUSING	8	OPEN 24 HOURS
FH-4	1855	FAMILY HOUSING	8	OPEN 24 HOURS
FH-5	1938	FAMILY HOUSING	8	OPEN 24 HOURS
FH-6	9481	FAMILY HOUSING	8	OPEN 24 HOURS
FH-7	457	FAMILY HOUSING	4	OPEN 24 HOURS
FH-8	947	FAMILY HOUSING	32	OPEN 24 HOURS
H-1	265	HOSPITAL, VETERANARIAN	44	WEEKDAYS - 7:30 A.M. TO 4:30 P.M. SATURDAY & SUNDAY - 8:00 A.M. TO 11:00 A.M.
H-2	4695	DENTAL CLINIC	50	WEEKDAYS - 7:30 A.M. TO 4:30 P.M.
L-1	2500	LAUNDRY	100	OFFICE - WEEKDAYS - 7:30 A.M. TO 4:00 P.M. STORE - WEEKDAYS - 7:30 A.M. TO 7:00 P.M.
M-1	9034	MOTOR POOL	15	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
M-2	5073	VEHICLE MAINTENANCE	6	WEEKDAYS - 6:00 A.M. TO 6:00 P.M. / OCCASIONAL WEEKENDS
M-3	1629	MAINTENANCE	5	WEEKDAYS - 6:00 A.M. TO 6:00 P.M.

TABLE 3 (CONT'D)
BUILDING OCCUPANCY
FORT BENNING

[illegible]

TABLE 4

Building Group Source Energy Consumption

Group	Description	Group Sq. Ft.	Total Source Consumption Btu's x 10 ⁶
A	Administrative	1,420,382	297,776
B	Barracks	5,106,181	1,236,951
CS	Community Service	1,328,359	278,032
D	Dining	301,697	188,962
FH	Family Housing	6,365,936	1,334,139
H	Hospital	512,629	148,121
L	Laundry	55,003	34,976
M	Maintenance	1,136,172	136,447
T	Training Facilities	455,771	120,702
U-1	Waste Water Treatment	3,154	5,572
U-2	Water Treatment	6,211	43,412
U-3	Pump Houses	4,967	62,342
U-4	Steam Plants	35,477	665
W	Warehouse	991,460	78,775
Z	Electric Only (includes outdoor lights and auxiliary)	485,238	136,905

ENERGY CONSERVATION PROJECTS
SOURCE ENERGY SAVINGS

BUILDING TYPE	ENERGY SAVINGS BTUx1,000,000	% BASEWIDE REDUCTION FY'75	PROJECT NUMBER
FAMILY HOUSING	113,696	2.89	T-553
	143,239	3.64	T-561
	76,040	1.93	T-563
	<u>332,975</u>	<u>8.46</u>	
BARRACKS	57,172	1.45	T-560
	29,239	0.74	T-557
	8,708	0.22	T-556
	<u>95,119</u>	<u>2.41</u>	
INCINERATOR FACILITY	204,124	5.18	T-576
STEAM PLANTS	73,596	1.87	T-559
SELECTIVE ENERGY PLANT	225,000	5.71	
OTHER BUILDINGS AFFECTED BY ECIP'S	4,391	0.11	T-566
	2,003	0.05	T-571
	32,519	0.83	T-560
	17,870	0.45	T-563
	11,200	0.28	T-554
	3,878	0.10	T-556
	<u>28,011</u>	<u>0.71</u>	T-577
	<u>99,872</u>	<u>2.53</u>	
TOTAL	1,030,686	26.18	

TABLE 5

ENERGY CONSERVATION PROJECTS DEVELOPED SCHEDULE - FT. BENNING, GEORGIA

PROJECT TITLE	PROJECT NUMBER	RECOMMENDED FISCAL YEAR	COST \$ x 1000	E/C RATIO	ENERGY SAVINGS BTUx10 ⁶	YEARS PAYBACK	B/C RATIO
REDUCTION OF BASEWIDE FLUORESCENT LIGHTING LOAD	T-556	1980	158	79.6	12,586	2.5	3.3
POWER FACTOR IMPROVEMENT	T-554	1980	217	51.6	11,200	11.1	1.5
INSULATED PANELS, STORM WINDOWS, AND WEATHERSTRIP DOORS IN PERMANENT BARRACKS	T-557	1980	657	44.5	29,239	6.5	2.9
STORM WINDOWS, WEATHERSTRIP DOORS, AND KITCHEN LIGHTING FIXTURE IN FAMILY HOUSING	T-553	1980	2436	49.3	113,696	7.5	2.4
TOTAL			3468		166,721		
REPLACE INCANDESCENT LIGHTING WITH HIGH PRESSURE SODIUM IN GYMNASIUM	T-566	1981	77	57.4	4,391	4.0	4.0
ADJUST FRESH AIR QUANTITIES	T-560	1981	371	242.0	89,691	1.3	14.1
STEAM PLANT MODIFICATIONS	T-559	1981	655	112.3	73,596	2.3	8.3
FM RADIO CONTROL SYSTEM	T-563	1981	867	108.3	93,910	2.2	5.4
FAMILY HOUSING EQUIPMENT MODIFICATIONS	T-561	1981	3231	46.7	143,239	9.4	2.1
TOTAL			5201		404,827		
SOLID WASTE BURING INCINERATOR FACILITY KELLEY HILL AREA	T-576	1982	6058	33.7	204,124	11.8	2.2
EMCS EXTENSION	T-577	1982	378	74.0	28,011	4.6	2.7
SOLAR HEATING OF FIELDHOUSE SWIMMING POOL AND SHOWER WATER	T-571	1982	81	24.6	2,003	14.7	1.3
TOTAL			6517		234,138		
SELECTIVE ENERGY PLANT		1983	29300	N/A	225,000	12.0	1.9
TOTAL			29300		225,000		

TABLE 6

TABLE 7
Energy Costs

Electricity	
Demand	\$4.41/kW
kWh (without demand) *	\$0.0217/kWh
kWh (including demand)	\$0.0339/kWh
Natural Gas	
Demand	\$2.99/mcf
Commodity (without demand)	\$0.6526/mcf
Commodity (including demand)	\$3.36/mcf
Propane	
Commodity	\$0.5894/gal
Fuel Oil	
No. 2	\$1.017/gal
No. 4	\$0.9194/gal
No. 6	\$0.8054/gal

*Use only when energy and demand savings are equally affected.

TABLE 8

Summary of Project Data

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	W/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Covering Wind Turbine and Gravity Type Ventilators in Winter	4 Bldgs.	774	\$ 3,304	0.12	276	2,013	\$ 385	\$ 18.23	Laborer 16.4	34 A24-1
Timer Switch for Restroom Exhaust	110	334.5	1,203	0.21	130	1,335	251	77.15	Electrician 4.5	31 A21-1
Flow Control Showerheads	Postwide	19.55	109	0.21	129	861.6	22.69	7.70	Laborer 0.5	21 A11-1
Install Air Curtains	100	8,717	33,648	0.4	47.9	583.8	14,930	13,500	Electrician 21	45 A37-1
Swimming Pool Cover	933	256	1,206	0.38	78.5	556	460	366	Carpenter 3	16 A8-1
Crawl Space Vent Panels	25 Buildings	5,215	24,458	0.39	76.4	535.8	9,713	2,008	Carpenter 255	41 A33-1
Eliminate Old Exhaust Hood	76	73.2	343	0.41	73.7	523	140	15.32	Laborer 6	32 A22-1
Seal Openings Around Window Air Units	Postwide	12.76	120	0.21	113	493	25.76	4.13	Laborer 1	35 A25-1
Reduction of Ventilation Air Quantities	3 Buildings	3,404	15,965	0.44	69.1	490	6,946	-	Laborer 319.5	36 A28-1
Water Restrictors	Postwide	15,889	102,115	0.32	75.3	480.7	33,055	15,039	Plumber 291	14 A6-1
Eliminate Hot Water	See Narrative	12,704	59,582	0.53	57.1	405.2	31,349	-	Plumber 914	11 A3-1
Receptacle Insulation	Family Housing	46,901	\$ 162,303	0.72	36.9	401.6	\$116,769	\$ 12,731	Laborer 4,244	15 A7-1
Energy Improvements to Five Company Barracks	4 Buildings	17,596	108,034	0.51	13.7	320.4	54,915	12,047	Painter 1,668	43 A35-1

TABLE 8

Summary of Project Data

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages
								Material	Manhours	
Relocate Ventilation Fans	9 barracks	632	1,561	1.7	12.7	245	2,577	-	Laborer 14 Electrician 2	53 A44-1
Eliminate and Seal Obsolete Vents	2,963	23.1	108	1.1	28.9	203.5	114	23	Laborer 4	33 A23-1
Reduce Infiltration in Family Housing	Family Housing	108,691	394,436	1.5	18.0	183	592,666	154,103	Laborer 16,380	26 A16-1
Reducing Exfiltration via Whole House Fans	Family Housing	3,537	14,500	1.84	13.1	132.5	26,692	7,677	Carpenter 500	39 A31-1
Steam Pipe Insulation Repair	5 Buildings	1,251	5,896	1.8	16.6	117.9	10,607	6,240	Laborer 53	10 A2-1
Remove Propeller Fans, etc.	4,345	1,507	14,678	0.9	26.0	113.8	13,250	5,920	Carpenter 160	52 A42-1
Energy Improvements to Old Hospital Buildings	7 Buildings	3,026	13,889	2.1	13.7	102.3	29,575	12,370	Laborer 559	40 A32-1
Insulate Water Heaters	Family Housing	10,430	49,021	2.44	12.3	87.1	119,753	49,862	Laborer 1988	24 A16-1
Upgrade Building 1054	1054	1,957	9,112	3.37	8.83	63.8	30,690	10,980	Plumber 54 Laborer 699	46 A38-1
Residential Hot Water Pipe Insulation	Family Housing	3,084	14,463	3.5	8.58	60.9	50,623	19,284	Laborer 2297	25 A15-1
Improve Building 2285	2285	305	1,088	5.13	4.90	54.6	5,585	2,320	Sheet Metal 4 Laborer 145	48 A39-1
Thermostatic Radiator Controls	17 Buildings	15,715	73,703	4.3	7.06	50.1	313,859	99,843	Plumber 4682	38 A30-1
Weatherstrip and Caulk Windows and Doors	26 Buildings	6,530	\$ 30,627	4.4	6.77	48.1	\$135,821	\$ 25,530	Laborer 4,978	44 A36-1

TABLE 8

Summary of Project Data

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages	
								Material	Manhours	Narr.	Calcs.
Improvements to Building 2402	2402	1,019	4,780	5.3	5.7	40.4	25,225	9,901	Carpenter 336	37	A29-1
Reinsulate Ceilings	3 Buildings	174	817	5.8	5.2	36.9	4,721	1,145	Laborer 136	42	A34-1
Solar Film	Postwide	0.12	0.57	5.9	5.08	36	3.35	-	-	12	A6-1
Conversion of Lighting System to HPS	5 Buildings	1,482	9,913	4.2	3.43	35.22	31,941	19,101	Electrician 350	27	A17-1
Install Dropped Ceiling and Insulate Floor	5	1,466	6,442	7.95	3.43	28.6	51,240	17,100	Carpenter 615	51	A41-1
Window Insulation	43 Buildings	3,732	18,706	8.6	3.24	23.3	160,303	7,022	Laborer 43,137	22	A12-1
Conversion of Lighting System to HPS	1726	197	1,611	5.5	2.69	22.0	8,930	4,181	Electrician 69	30	A20-1
Install Storm Windows and Solar Film	390	293	1,204	12.2	1.94	19.9	14,690	9,080	Carpenter 152	49	A60-1
Window Reduction	47 Buildings	10,724	40,824	15.3	1.86	17.14	625,627	248,821	Carpenter 9,143	23	A13-1
Conversion of Lighting System to HPS	2962	656	4,767	9.3	1.68	14.8	44,402	19,753	Electrician 387	28	A18-1
Conversion of Lighting System to HPS	5 Buildings	1,166	9,700	9.8	1.57	12.3	94,866	42,688	Electrician 806	29	A19-1
Flush Valve Restrictors	Postwide	-	30,343	0.67	13.5	-	20,292	9,639	Plumber 161	8	A1-1
Toilet Tank Dams	Family Housing	-	17,249	2.25	4.0	-	38,882	20,496	Laborer 341	13	A5-1

TABLE 9

Summary of Project Data

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	B/C	E/C	Contract Cost	In-House Cost		Reference Pages Narr. Calcs.
								Material	Manhours	
Steam Pipe Insulation	28 Buildings	32,831	\$153,977	0.45	67	476	\$69,005	\$29,462	Laborer 1,225	5 B2
Eliminate Chilled Water for Water Coolers	196 Buildings	8,307	26,240	0.25	86.1	124.6	6,479	--	Electrician 178	10 B7
Weatherseal Large Doors	26 Buildings	4,626	21,695	1.75	17.1	121.5	38,077	19,896	Carpenter 283	4 B1
Ceiling Fans	9 Buildings	9,528	46,655	2.4	12.9	86.7	109,884	38,219	Electrician 1,407	15 B10
Hospital EMCS	Hospital	18,164	84,458	3.53	8.4	60.8	298,528	---	---	27 B19
Fluorescent Lighting Load Reduction	Postwide	12,581	67,843	3.4	5.9	54.6	230,328	106,253	Electrician 1,847	19 B12
Reduce Infiltration in Temporary Buildings	632 Buildings	42,576	331,102	2.44	11.0	52.6	808,721	155,552	Laborer 29,360	22 B14
Insulate Temporary Buildings	632 Buildings	75,934	593,104	3.1	9.1	41.3	1,838,339	445,723	Laborer 53,087	23 B15
Electronic Ignition on Furnaces	2,984 Housing Units	27,699	121,944	7.26	4.0	31.3	884,808	687,303	A/C Mechanic 7,950	7 B4
Hangar Ceiling and Wall Insulation	11 Buildings	18,397	93,502	7.2	4.2	27.3	674,977	223,024	Carpenter 11,013	28 B20
Sliding Glass Storm Doors	2,214 Housing Units	21,401	92,470	12	2.2	19.2	1,111,852	638,766	Carpenter 4,428	9 B6
Exterior Wall Insulation	Building 4	14,961	70,168	11.2	2.7	19.0	787,500	---	---	25 B17
Exterior Wall Insulation	Postwide 4	.10/sq.ft.	.50/sq.ft.	12.3	1.8	16.4	6.16/sq.ft.	---	---	30 B22
Infrared Heating	6 Buildings	2,234	10,477	13.7	2.2	15.5	143,623	59,680	A/C Mechanic 1,542	21 B13